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ABSTRACT

Given that elderly adults depend more heavily on their ability to communicate as independent activity becomes more restricted, their ability to alter the supersegmental component of the message becomes crucial. A study investigated the ability of older speakers to alter their speaking rate and to determine the strategies used to accomplish rate variations. Subjects, twenty males and females between the ages of 69 and 82 years and twenty males and females between the ages of 23 and 32 years, were asked to repeat a nursery rhyme nine times: three times at a normal speech rate, three times at an autophonic rate judged by the speaker to be twice as fast as normal, and three times at a slow rate judged by the speaker to be one-half as fast as normal. Comparison of the results of young adult and older speakers in the normal rate task showed that older adults produced significantly fewer syllables per second than did the young adults. This finding supports previous studies that found that speaking rate declined in the elderly. Findings also showed that both age groups used similar strategies for altering their speech rate, but older adults were not as effective in increasing the speech rate and in reducing the pause length in the fast speaking condition. (References and a table of data are included.) (NKA)

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Temporal Alteration Strategies
in Older Speakers

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Abstract

Four variables for altering the prosodic feature of rate in normal, fast, and slow speaking rates were assessed in older and young adult speakers. The twenty older adults (mean age of 74 years) produced significantly fewer syllables per second in normal and fast speaking rates and longer pauses in the fast speech condition compared to young adult speakers (mean age of 29.4 years). No significant age differences were found in the slow speaking condition, in the number of pauses at any speaking rate, or in the speech-time ratio at any rate.

Temporal Alteration Strategies in Older Speakers

Changes in speech rate are one of the prosodic devices used by speakers to enhance effectiveness of communication, to convey emotional impressions, to clarify information, or to keep a listeners' interest through manipulation of supersegmental features of speech production (Leathers, 1986). Although interest in paralinguistics is increasing, minimal research in the area of rate has been accomplished. Since older adults depend more heavily on the ability to communicate as independent activity becomes more restricted, the ability to subtly alter the supersegmental component of the message to accurately reflect intention and convey meaning becomes crucial.

RATE

Several studies of typical speaking and/or reading rates of older adults have investigated normal production rates for older speakers. The typical speech of aged speakers is perceived as slow (Ryan & Burk, 1974; Hartman & Danhauer, 1976; Kukul, 1979) with objective measurements showing a slow reading rate (Mysak & Hanley, 1958; Pierce, Burk, and Hoyer, 1978; Ryan, 1972). Although Ptacek et al. (1966) found slower maximum diadochokinesis rates in aged speakers, Shanks (1970), in her study of women aged 20 to 80 years, found no significant rate differences. Other researchers have investigated the contribution of the pause to elderly speakers' slow reading rates. Several researchers (Shipp & Hollien, 1959; Pierce, Burk, & Hoyer, 1978) found indications of greater use of pausing between young adult and aged speakers in reading. In addition

to increases in total pause time and frequency of nonorthographic pauses in the oldest age-groups, Oyer and Deal (1985) also found that males utilized pauses significantly more often and of greater duration than do females

Although some generalizations about typical speaking rate of older speakers can be made, the ability of older adults to vary speaking rate has not been investigated. Lane and Grosjean (1973), testing normal young adult speakers, found three variables which resulted in changes in autophonic reading rate. Autophonic reading rates were based on the subject's self-judged compliance with the task of altering speaking rate (Grosjean & Lane, 1974). Change in the number of pauses was the most important variable with alteration of articulatory rate and change in pause duration used much less frequently. In studying strategies used to increase and decrease reading rate, Lass and Dunn (1971) also identified the variable of speech-time ratio as a measure of speech rate. It is the purpose of the present study to investigate the ability of older speakers to alter speaking rate and to determine the strategies used to accomplish rate variations.

METHOD

Subjects: Ten males and ten females between the ages of 69 and 82 years (mean ages of 74.5 and 73.6 years respectively) and ten males and ten females between the ages of 23 and 32 years (mean ages of 29.8 and 29.0 years respectively) served as subjects. No person was included in the investigation who was taking hormonal medication, who indicated a history of respiratory disease, who smoked within the past ten years,

or who indicated drinking in excess of one ounce of alcohol daily. None of the subjects reported having received speech therapy, indicated a speech-related pathological condition, or displayed any speech disorder observable to a certified speech-language pathologist. Each subject demonstrated hearing thresholds equivalent to, or better than, the composite presbycusic curves for the appropriate age (Lebo & Reddell, 1972).

Procedures: Subjects were tested in an isolated, sound-treated testing suite between noon and 3 p.m. The subjects produced the nursery rhyme, "Mary had a Little Lamb" nine times: three times at a normal speech rate, three times at an autophonic rate judged by the speaker to be twice as fast as normal, and three times at a slow rate judged by the speaker to be one-half as fast as normal. Ten randomized sequences of the nursery rhyme repetitions were generated for the ten subjects in each group. A large print copy of the nursery rhyme was provided to control for memory variations. This task was selected since it is typical of tasks used in rate alteration studies, is familiar to young and older subjects, and controls for inter-cohort variation of prosodic features possibly due to educational training.

The subjects' voices were recorded on an Ampex Tape recorder Model AF 500-2 in conjunction with a 802 Ampex microphone. A 6-inch mouth to microphone distance was maintained for each subject. Rest time was allowed between the readings of the nursery rhyme.

The recorded speech signal was applied to a General Radio Graphic Level Recorder Model 1521-B. The Graphic Level Recorder was set at a pen

speed of 500 mm/sec and a paper speed of 10 mm/sec. The stylus was adjusted to indicate pauses by returning to a preset baseline. The recordings were also monitored to exclude audible inhalations from the graphic display.

The total time in reading/speaking each repetition of the nursery rhyme was determined from this display. The average number of syllables produced per second for each of the three repetitions of the three reading rates was calculated for each subject. The average number of pauses and the average length of pauses were also calculated for each reading rate. Speech-time ratio (Lass & Deem, 1970) was determined as the ratio of time spent in speaking to the total time speaking including pauses.

RESULTS

Table I presents data for the young adult and older adult speaker groups for each of the three rate conditions. Number of syllables per second, speech-time ratio, number of pauses, and length of pauses are recorded.

Insert Table I Here

A significant age-rate interaction ($F(1, 36) = 10.469, p < .05$) for the syllables per second condition was obtained. Following statistical analysis revealed that older speakers produced significantly fewer syllables per second than did younger speakers in the twice-normal rate (fast) and normal rate conditions.

A significant within subject factor for rate ($F(1,36) = 94.36$, $p < .001$) was obtained for speech-time ratio. Although age differences were not found, speakers demonstrated significantly greater speech-time ratios for the fast condition and significantly reduced ratios for the slow speaking conditions.

The number of pauses was significantly different in each of the reading rates ($F(1,36) = 67.98$, $p < .001$) with faster rates using fewer pauses. The number of pauses produced by younger and older speakers within each reading rate was not statistically different.

The average pause length was shortest for all groups in the fast rate condition with an age-rate interaction obtaining significance ($F(1,36) = 4.5$, $p < .05$). Followup analysis of wholely significant differences revealed significantly longer pauses used by older speakers only in the fast or twice normal rate condition.

DISCUSSION

Comparison of the young adult and older speakers in the normal rate task shows that older adults produce significantly fewer syllables per second than the young adults. This reduction in rate supports previous objective and perceptual studies which found the rate of speaking reduced in the aged. Significant differences between young and older adult productions for the normal rate condition did not occur for the variables of number of pauses, pause length, and speech-time ratio. Factors other than pause length and number may have contributed to the reduction in number of syllables per second produced by older adults when speaking at a normal rate. Ryan (1972) also suggested a characteristic

other than pause-time as affecting the rate of reading of his older group. Articulation rate, a perceptually important rate change device (Grosjean & Lane, 1974), may have contributed to the reduction of number of syllables per second while pausal factors were nonsignificant. The significant lengthening of vowel productions found in older speech production (Benjamin, 1982) may be a relevant non-pausal rate factor.

Expected alteration in number of syllables per second, speech-time ratio, number of pauses, and pause length were observed in the assessed autophonic rate changes. Compared with normal speaking rates, both young and older speakers produced a greater number of syllables per second when speaking in a twice-normal rate and fewer syllables per second when speaking in a rate judged as one-half the rate of the normal speech. The speech-time ratio, significantly greater in rapid speaking and reduced in the slow speech condition, supports the finding that pause-time is a strategy used by all aged speakers in rate reduction. The number of pauses increased for both speaker groups in the twice-normal rate and decreased in the half-normal rate. Alteration of number of pauses has been identified as the primary method for altering speaking rate (Lane & Grosjean, 1973).

The final factor, length of pause, was considered by Lane and Grosjean (1973) as much less important as a rate alteration strategy number of pauses. Analysis of the data presented in Table I shows that pause length was not significantly different in the normal and half-normal rate conditions, but that pause length was significantly shorter in the twice-normal speaking rate for both groups. Although

both age groups use significantly shorter pauses in the fast speaking rate condition, the older speakers produced significantly longer pauses than the young adult speakers in this condition.

Both age groups used similar strategies for altering speech rate, but younger adults were more effective in increasing speech rate and reducing pause length in the fast speaking condition. Several factors may account for these results. Neuomuscular changes accompany advancing age and a general slowing of behavior in older adults has been consistently noted (Birren, Woods, & Williams, 1980; Salthouse, 1985). Ryan and Burk (1974) have suggested a mild dysarthric component to the speech of older subjects. These changes may result in lengthened pause time due to a reduced ability to initiate speech production following the pause. In addition to physiological factors, psychological factors such as the conservative nature of older adults (Norris & Rubin, 1984) and the novel task of altering speech rate may have affected performance.

The present study has established that young and older adult speakers use similar strategies in altering speaking rate but that older speakers are not as effective as young adult speakers in increasing speaking rate. The controlled nature of the speaking task conditions were necessary to establish the similarities and differences of rate alteration in a controlled, neutral task. Further investigation of these abilities in creating effective prosodic strategies to alter conveyed meaning and emotional overtones within conversation discourse may offer insight into communication barriers affecting older communicators.

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Table I

Twice Normal Rate Condition

	<u>Syllables/ Second</u>	<u>Speech- Time Ratio</u>	<u>Number of Pauses</u>	<u>Pause Length</u>
Young male	5.9	.95	2.2	.19
Young female	6.5	.97	1.7	.15
Older male	4.6	.94	3.5	.24
Older female	5.1	.94	2.8	.26

Normal Rate

Young male	4.1	.87	5.9	.34
Young female	4.4	.91	4.6	.27
Older male	3.5	.85	6.9	.35
Older female	3.6	.86	7.4	.28

One-Half Normal Rate Condition

Young male	2.7	.78	12.6	.37
Young female	2.9	.83	14.2	.28
Older male	2.7	.78	13.1	.37
Older female	2.5	.78	15.8	.35